

**U.S. HOUSE OF REPRESENTATIVES  
COMMITTEE ON SCIENCE  
SUBCOMMITTEE ON RESEARCH**

**HEARING CHARTER**

***International Polar Year: The Scientific Agenda and the Federal Role***

**Wednesday, September 20, 2006  
10:00 a.m. - Noon  
2318 Rayburn House Office Building**

**1. Purpose**

On Wednesday, September 20, 2006, the Research Subcommittee of the Committee on Science of the House of Representatives will hold a hearing to examine the research planned for the upcoming International Polar Year (IPY) and the U.S. role in the IPY.

**2. Witnesses**

**Dr. Arden Bement** is the Director of the National Science Foundation (NSF).

**Dr. Robin Bell** is a Doherty Senior Research Scientist at the Lamont-Doherty Earth Observatory of Columbia University. She chairs both the Polar Research Board of the National Academy of Sciences and the U.S. Committee to the IPY and serves as vice-chair of the International Council for Science (ICSU, based on the French acronym) Planning Group for the IPY.

**Dr. Kelly K. Falkner** is a Professor of Chemical Oceanography at Oregon State University and is a member of the Advisory Committee to the NSF Office of Polar Programs.

**Dr. Donal T. Manahan** is a Professor of Biology at the University of Southern California and runs an NSF-funded program to provide graduate students with research experience in Antarctica.

**Mr. Mark S. McCaffrey** is an associate scientist and science communications specialist at the Cooperative Institute for Research in Environmental Sciences (CIRES) at University of Colorado, Boulder. He is a member of the ICSU IPY Education, Outreach, and Communications Subcommittee.

**3. Overarching Questions**

- What are the most critical unanswered questions that we hope to resolve with the research conducted during this IPY? What are the societal benefits of this research? What has been learned from polar research and IPYs in the past?

- What role will each of the Federal agencies play in the IPY? What is the U.S. role in the IPY, and how does the U.S. collaborate with international participants?

#### **4. Brief Overview**

- The IPY will consist of an intense, internationally coordinated effort of polar observations, research and analysis in many scientific fields, including study of how the Earth's remote polar regions influence global climate systems. The IPY also hopes to inspire the next generation of scientists and to educate the public about the polar regions.
- The IPY will begin in March 2007 and run through March 2009 so that scientists have the opportunity to work in both polar regions during the IPY or to study the poles during both summer and winter seasons. This is the fourth IPY, and it celebrates the 50th anniversary of the International Geophysical Year.
- To date, 38 nations have expressed interest in participating in the IPY. International coordination occurs through the ICSU and the World Meteorological Organization (WMO). In the U.S., the Federal agencies actively involved in IPY are NSF, the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), the Department of Defense (DOD), the National Institutes of Health (NIH), the U.S. Geological Survey (USGS), the Department of the Interior (DOI) and the Smithsonian Institution.<sup>1</sup>
- The White House has designated NSF, which manages the U.S. Antarctic Program and chairs the Interagency Arctic Research Policy Committee, to be the lead Federal agency for the IPY. NSF's fiscal year 2007 (FY07) budget request includes \$62 million for research related to the IPY, including research on how the Arctic environment is changing, the history and dynamics of polar ice sheets, and how life forms adapt to harsh polar environments, and funding for associated logistics, infrastructure, and education and outreach activities. (NSF has funded research in these areas for many years, but is increasing its focus on, and funding for them in concert with the IPY.) Overall, the proposed NSF budget for FY07 is \$6.0 billion, of which \$438 million is for polar research programs and logistical support; both House and Senate appropriators have provided NSF with the requested overall level for FY07.

#### **5. U.S. Agencies and the IPY**

While the IPY is in an international effort, the approval of individual research projects is left up to each nation. ICSU, an international, non-governmental science organization, and the WMO are coordinating the IPY through a joint committee and a program office. That committee has enumerated themes for IPY research. Scientists wishing to undertake IPY research can submit their proposals to the committee, which then decides, based on the topic, whether the research

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<sup>1</sup> Other U.S. agencies and organizations that have sponsored or participated in IPY planning workshops, are members of the Interagency Arctic Research Policy Committee (IARPC), and/or have interests in the polar regions include the Department of Agriculture, the Department of Education, the Department of Homeland Security, the Department of State and the Environmental Protection Agency.

can be considered an IPY activity. The application process is essentially over, and the committee has endorsed about 225 projects and is reviewing another 900 or so. Committee approval is not based on a review of the quality of the project, and few applications are rejected. (The committee also establishes guidelines for sharing of data and other aspects of research conduct.)

Federal research agencies in the U.S. have begun to solicit research proposals for the IPY (primarily through existing research programs), and it is not clear how the review process will take into account whether a project has already been designated as an IPY project through the ICSU-WMO process.

Of the Federal agencies involved in the IPY – NSF, NOAA, NASA and DOE – only NSF's FY07 budget request specifically describes funds to be dedicated to IPY activities. These funds will go to expand support for ongoing research in areas related to the IPY. NSF has proposed spending \$62 million on IPY activities in FY07, an increase of \$8.3 million over FY 06 levels for research in those areas.

NSF will distribute IPY funding both through ongoing programs and via IPY-specific solicitations seeking project proposals in high-priority research areas, such as Arctic climate monitoring, and IPY-related education and outreach activities. The first such solicitation was released in January 2006 (to distribute \$12 million in FY06 funds), and NSF is expected to announce this fall which projects were selected for funding. Proposed projects must include a description of their relevance to the IPY, but they are not required to have been endorsed by the ICSU-WMO process.

## **6. Background**

### *History of IPY*

Over the past 125 years, there have been three occasions when scientists from all over the world gathered together to concentrate on research in the polar regions. Each occasion was marked by significant breakthroughs in scientific knowledge, provided benefits to society, sparked continued collaboration among participants, and set the stage for several political accords.

The first IPY took place in 1882-1883 when it was agreed that one nation alone could not adequately study the geophysical attributes of the polar regions. Twelve countries participated, with 13 expeditions to the Arctic and two expeditions to the Antarctic. The international legacy of this first IPY was that it set a precedent for international science cooperation. For the U.S., an immediate result was the creation of a permanent science station at Point Barrow, Alaska, the northernmost point of the U.S. To support this first IPY, Congress appropriated \$33,000 to the Army Signal Corps of the War Department.

In 1932, a second IPY was proposed by the forerunner of the World Metrological Organization (WMO) in an effort to study the implications of the newly discovered jet stream. Forty nations participated in this IPY, which led to advances in meteorology, atmospheric sciences, and understanding of the Earth's magnetic field. Research findings on the nature and structure of the

ionosphere surrounding the Earth also enabled significant improvements in radio communications. Part of the U.S. contribution to this IPY was the Byrd Antarctic expedition, which created the first inland research station (a winter-long meteorological station) in Antarctica. In addition, 40 permanent observation stations were established in the Arctic. The total U.S. investment for the 1932 IPY was approximately \$100,000.<sup>2</sup>

Perhaps the most notable of the IPYs, and what the upcoming IPY hopes to build on, was the 1957-1958 International Geophysical Year (IGY). Originally referred to as the third IPY, organizers expanded the research opportunities beyond the polar regions and changed the name to the IGY in an effort to garner more international participation. Sixty-seven nations and over 80,000 scientists participated in the IGY. Part of the impetus for the IGY came from World War II physicists who wanted to redirect newer technologies from the war (radar and rockets) toward research applications, specifically the study of the upper atmosphere. Among the scientific successes of the IGY were the first informed estimates of the total size of Antarctica's ice mass, the confirmation of the phenomenon of continental drift, and the discovery of the Van Allen Radiation Belt surrounding Earth. Politically, the relationships developed during the IGY and the successes of the scientific collaborations helped lead to the ratification of the Antarctic Treaty in 1961. Much of today's polar research builds upon discoveries made during the IGY.

In the U.S., Federal support for IGY primarily flowed through NSF, which was established in 1950. Between 1955 and 1961, NSF spent \$59 million on IGY activities.<sup>3</sup> Additional funds were spent by other government agencies,<sup>4</sup> universities, and private laboratories.

#### *Upcoming IPY (2007-2008)*

In *A Vision for the International Polar Year 2007-2008*,<sup>5</sup> the U.S. National Committee for IPY, an arm of the National Academy of Sciences, identified five scientific challenges for the U.S. to address:

1. Assessing large-scale environmental change in the polar regions, with questions looking at both the physical and human dimensions of change and its impacts.
2. Conducting scientific exploration of new frontiers, whether these are once inaccessible places such as the seafloor, or areas of inquiry that are now open because of advances in technology, such as how the tools of genomics now allow exploration of previously unanswerable questions about biological adaptation.
3. Observing the polar regions in depth, with adequate coverage of the vast and challenging landscape, to provide a description of current conditions and allow for better future understanding of variability and change.

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<sup>2</sup> Of the \$100,000 U.S. investment in the second IPY, \$30,000 was Federal funds from the Department of State. Other funding came from university and private sources.

<sup>3</sup> In the early years, IGY was a significant piece of NSF's budget; in 1956 nearly half of NSF funding was dedicated to IGY.

<sup>4</sup> Other agencies providing support for IGY in some capacity included the Department of Defense, the State Department, the Commerce Department, the Atomic Energy Commission, and the Office of Defense Mobilization.

<sup>5</sup> *A Vision for the International Polar Year 2007-2008*, National Academy of Sciences, 2004; available online at <http://newton.nap.edu/html/ipr2007-2008/0309092124.pdf>.

4. Understanding human-environmental dynamics in a region where the connections are intimate and where the impacts of change are clear.
5. Creating new connections between science and the public, using these regions that are inherently intriguing.

Education and outreach is a key focus of the upcoming IPY. IPY participants plan to share the research experiences with K-12 students, people who live in the polar regions, decision-makers, and the general public. Specific activities planned include websites, workshops, newsletters, press kits, classroom remote participation and interactive programs, and polar theme contests and class lessons.

### *NSF Polar Research Programs*

NSF is the lead Federal agency supporting research at the North and South Poles. As an example, a recent survey of polar ice sheet's drainage basins provided a wealth of data for scientists studying the process of and reasons for the disappearance of glaciers. Ongoing research also includes studies on how the Antarctic mountain ranges formed and seismic and geochemical monitoring of Mt. Erebus, the world's southernmost active volcano.

In addition to projects that study the polar continents themselves, NSF also supports research in a variety of fields that can be conducted only at the poles. For example, the cold, dry climate and high altitude at the South Pole provide an excellent environment in which to make certain astrophysics measurements (such as looking at faint signals of radiation from when the universe was young). Finally, NSF also provides logistical and infrastructure support for polar research, including permanent and temporary research stations at the poles, research vessels, interagency leadership for research planning, and management of all U.S. activities in Antarctica. For FY07, the NSF budget request for polar research programs and logistical support is \$438 million, \$49 million over the FY06 level.

For the IPY, NSF will continue and expand ongoing polar research activities as well as provide logistical support. Specifically, research programs on how the Arctic environment is changing, the history and dynamics of polar ice sheets, and how life forms adapt to harsh polar environments have been identified as priorities for IPY and beyond. In FY06, the NSF budget for IPY planning activities was \$12.4 million, and the FY07 NSF budget request includes \$61.6 million to begin funding IPY research.

Projects to gather data on and model the Arctic climate will be part of the interagency Study of Environmental Arctic Change (SEARCH) program, a long-term program in which NSF, NOAA, and NASA are building a network of observing sites to monitor environmental change in the Arctic and supporting research on causes and impacts of the change. During the IPY, NSF will support the development of an international network to measure climate throughout the Arctic and to tap the knowledge of indigenous peoples about their environment.

Research on glaciers will occur under the Polar Ice Sheet Dynamics and Stability program and is aimed at better understanding the ice sheets' impact on global climate change. A primary focus will be drilling projects to obtain samples from deep within the Antarctic ice sheets, mountain

ranges, and ocean floors to improve our understanding of Antarctic climate over the past 40,000 years and gather data that can be compared to changes that occurred in the Arctic.

Studies on how life forms are able to adapt and survive the harsh temperatures and darkness of the polar regions are supported under NSF's program on Life in the Cold and Dark. Research projects will focus on studying how organisms have changed at the cellular and genomic levels and include investigations of human adaptation and how infectious diseases evolve due to climate change. During IPY, NSF will support research in this area at Toolik field station in Alaska, at Summit, Greenland; and in the McMurdo Dry Valleys of Antarctica.

In addition to these priority areas, other NSF initiatives planned for the IPY include efforts to improve climate modeling and upper atmosphere studies to better understand space weather. NSF's education and outreach plans include support for museum exhibits and film, television and radio documentaries; development and distribution of classroom materials for teaching about polar research; and polar research field experiences for undergraduate and graduate students and K-12 educators. One museum exhibit of photographs by the recipient of an NSF Antarctic Artists and Writers Program grant, *Wondrous Cold: An Antarctic Journey*, has already been displayed at the Smithsonian Museum of Natural History and is currently traveling around the country.<sup>6</sup>

#### *Other Federal Agency Polar Programs and IPY Activities under Science Committee Jurisdiction*

##### National Oceanic and Atmospheric Administration

NOAA's FY07 proposed budget does not include new funds specifically for the IPY, but it does include \$9.27 million for ongoing NOAA activities in the polar regions. These activities are consistent with the international goals for the IPY, and NOAA plans to coordinate their projects with other U.S. and international IPY activities. The planned NOAA projects include exploration of polar oceans, research on how to improve prediction and modeling of polar climates, polar atmospheric and stratospheric observations, studies on causes and impacts of Pacific Arctic change, and surveying of Antarctic marine life.

##### National Aeronautics and Space Administration

In addition to ongoing activities in support of the SEARCH program, NASA has a variety of education and outreach plans for during the IPY. For example, NASA is collaborating with NSF and NOAA on three IPY education and outreach symposia. These symposia are designed for educators and will focus on ways to teach about polar topics, such as the fragile ice, life in the cold and dark, and the effect of the water and energy cycle on polar regions and climate change. Existing NASA funds will be used for these activities.

##### Department of Energy

While no Federal funds have been specifically requested for IPY activities at DOE, the DOE Office of Science has committed to deploy an Atmospheric Radiation Measurement mobile facility to the Arctic during the IPY to study the impact of clouds, aerosols and surface characteristics on the Arctic climate. The FY07 budget request for this activity is \$3.5 million.

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<sup>6</sup> For details about the exhibit and its travel schedule, see <http://www.sites.si.edu/exhibitions/exhibits/wondrous/main.htm>.

## **6. Witness Questions**

The witnesses were asked to address the following questions in their testimony:

Questions for Dr. Arden Bement and Dr. Robin Bell:

- What has been learned from polar research and the IPYs in the past, and what do we hope to learn during this IPY?
- How will research conducted during this IPY relate to ongoing polar research programs at NSF?
- What is the U.S. role in the IPY, and how does the U.S. collaborate with international participants? What role will each of the Federal agencies play in the IPY?
- What are the most critical unanswered questions that you hope to resolve with the research conducted during this IPY? What are the societal benefits of this research?

Questions for Dr. Kelly Falkner and Dr. Donal Manahan:

- What has been learned from polar research and the IPYs in the past, and what do we hope to learn during this IPY?
- What are the most critical unanswered questions that you hope to resolve with the research conducted during this IPY? What are the societal benefits of this research?

Questions for Mr. Mark McCaffrey:

- What has been the impact of polar research and the IPYs on students and the public in the past?
- What education and outreach activities are planned for this IPY? What are the goals and expected societal benefits of these activities?